

1. A dispensing apparatus capable of delivering precise quantities of a liquid product less than 1 mm³ in size, comprising:

a drive mechanism;

5 a housing having at least two input channels coupled to a chamber having a first portion and a second portion, such that a first component liquid is delivered through a first input channel of the at least two input channels to the chamber, and a second component liquid is delivered through a second input channel of the at least two input channels to the chamber, where the first input channel and the second input channel are disposed so that interaction is hindered between the first component liquid
10 and the second component liquid in either input channel;

at least one feed screw having a helical thread and disposed in the chamber, where the at least one feed screw, rotated by the drive mechanism mixes the first and second component liquids to form a liquid product and discharges the liquid product from the chamber.

15

2. The dispensing apparatus of claim 1, further comprising a dispenser tip in liquid communication with the output channel for dispensing a controlled amount of product.

20 3. The dispensing apparatus of claim 2, wherein the dispenser tip is disposable.

4. The dispensing apparatus of claim 1, wherein the dispensing apparatus further comprises a controller for controllably rotating the at least one feed screw.

25 5. The dispensing apparatus of claim 1, wherein the chamber further comprises a side wall, wherein the chamber is cylindrical in shape having an axis extending centrally and longitudinally through the housing and the side wall forms a substantially cylindrical internal volume.

30 6. The dispensing apparatus of claim 5, wherein the first and second input channels extend radially from the axis of the chamber where the second input channel

is closer to the first portion of the chamber than the first input channel and the first and second input channels are separated in a direction along the axis of the chamber to preclude interaction of the first and second component liquids in either input channel.

- 5 7. The dispensing apparatus of claim 1, wherein each input channel of the at least two input channels has an axis and are attached to the chamber at a common location and an angle formed by the two axes of each input channel is acute.
8. The dispensing apparatus of claim 1, wherein the two input channels further
10 comprise an inlet end attached to the chamber and a storage end, wherein a storage reservoir is mounted to the storage end of each input channel.
9. The dispensing apparatus of claim 8, wherein the storage reservoir further
15 comprises a delivery mechanism to deliver liquid to each input channel.
10. The dispensing apparatus of claim 1, wherein the chamber further comprises a third portion having internal walls that are substantially parallel and the chamber is cylindrical in shape where the internal walls form a substantially cylindrical internal volume, wherein the helical threads of the at least one feed screw are in sliding
20 contact with the internal walls of the third portion of the chamber.
11. The dispensing apparatus of claim 10, wherein the at least one feed screw further comprises helical threads having a variable pitch that decreases as the helical threads approach the second portion of the chamber.
- 25 12. The dispensing apparatus of claim 1, wherein the chamber further comprises a third portion having internal walls that are tapered and the chamber is cylindrical in shape where the internal walls form a substantially cylindrical internal volume, wherein the third portion has a starting diameter near the first portion that varies
30 becoming smaller as the walls approach the second portion; and wherein the helical

threads of the at least one feed screw are in sliding contact with the internal walls of the third portion of the chamber.

13. The dispensing apparatus of claim 12, wherein the at least one feed screw
5 further comprises helical threads having a linear pitch.

14. The dispensing apparatus of claim 1, wherein the at least one feed screw
further comprises two feed screws having helical threads, and wherein the drive
mechanism drives the two feed screws.

10

15. The dispensing apparatus of claim 14, wherein the chamber further comprises
a third portion having two partly overlapping cylindrical bores and the two feed
screws are rotatably supported in the two partly overlapping cylindrical bores of the
barrel body.

15

16. The dispensing apparatus of claim 15, wherein the two partly overlapping
cylindrical bores have a region of overlap and the two partly overlapping cylindrical
bores having internal walls that are substantially parallel, and wherein the helical
threads of the two feed screws are in sliding contact with the internal walls of the third
20 portion of the chamber and where the helical threads of the two feed screws are
inter-meshing in the region of overlap.

17. The dispensing apparatus of claim 15, wherein the two feed screws further
comprise helical threads having a variable pitch that decreases as the helical threads
25 approach the second portion of the chamber.

18. The dispensing apparatus of claim 14, wherein the chamber further comprises
a third portion having two non-overlapping cylindrical bores having internal walls that
are substantially parallel and the two feed screws are rotatably supported in the two
30 non-overlapping cylindrical bores of the barrel body, wherein the helical threads of
the two feed screws are in sliding contact with the internal walls of the third portion of

the chamber and where the helical threads of the two feed screws are non-intermeshing.

19. A dispensing apparatus capable of delivering quantities of a liquid product,
5 comprising:
a drive mechanism;
at least one feed screw having a helical thread;
a housing having a main body and a front body, where the main body is
attached to the front body wherein the main body and the front body when attached
10 form an internal cavity having a main cavity, a drive cavity, an output cavity and two
input cavities;
a disposable insert having a chamber, a first portion, a second portion, and two
input channels where the disposable insert conformally fits within the internal cavity
of the housing, such that a first component liquid is delivered through a first input
15 channel of the at least two input channels to the chamber, and a second component
liquid is delivered through a second input channel of the at least two input channels,
where the first input channel and the second input channel are disposed so that
interaction is hindered between the first component liquid and the second component
liquid in either input channel;
20 at least one feed screw having a helical thread and disposed in the chamber,
where the at least one feed screw, rotated by the drive mechanism mixes the first and
second component liquids to form a liquid product and discharges a precise amount of
the liquid product from the chamber.
20. The dispensing apparatus of claim 19, wherein the disposable insert is
25 removable from the housing when the main body and the front body are detached, and
wherein a new disposable insert substantially mates with the internal cavity of the
housing.
21. The dispensing apparatus of claim 19, wherein the housing further comprises a
30 locking mechanism and a hinge mechanism coupling the main body to the front body.

22. The dispensing apparatus of claim 19, further comprising a disposable dispenser tip in liquid communication with the output channel for dispensing a controlled amount of product.

5

23. The dispensing apparatus of claim 19, wherein the two input channels extend radially from the chamber where one input channel is closer to the first portion than the second input channel and separated by a least a distance sufficient to preclude interaction of the first and second component liquids in either input channel.

10

24. The dispensing apparatus of claim 19, wherein one input channel descends to the chamber and the second input channel ascends to the chamber, wherein the two input channels are attached to the chamber at a common location and the angle formed by the two input channels is acute.

15

25. The dispensing apparatus of claim 19, wherein the two input channels further comprise an inlet end attached to the chamber and a storage end, wherein a storage reservoir is mounted to the storage end of each input channel.

20 26. The dispensing apparatus of claim 19, wherein the chamber further comprises a third portion having internal walls that are tapered, wherein the third portion has a starting diameter near the first portion that smoothly varies becoming smaller as the walls approach the second portion; and wherein the helical threads of the at least one feed screw are in sliding contact with the internal walls of the third portion of the
25 chamber.

27. The dispensing apparatus of claim 26, wherein the at least one feed screw further comprises helical threads having a linear pitch.

28. The dispensing apparatus of claim 19, wherein the at least one feed screw further comprises two feed screws having helical threads where the drive mechanism drives the two feed screws.

5 29. The dispensing apparatus of claim 28, wherein the chamber further comprises a third portion having a barrel body having two partly overlapping cylindrical bores and the two feed screws are rotatably supported in the two partly overlapping cylindrical bores of the barrel body.

10 30. The dispensing apparatus of claim 29, wherein the two partly overlapping cylindrical bores have a region of overlap and the two partly overlapping cylindrical bores having internal walls that are substantially parallel, wherein the helical threads of the two feed screws are in sliding contact with the internal walls of the third portion of the chamber and where the helical threads of the two feed screws are intermeshing
15 in the region of overlap.

31. The dispensing apparatus of claim 29, wherein the two feed screws further comprise helical threads having a variable pitch that decreases as the helical threads approach the second portion of the chamber.

20

32. The dispensing apparatus of claim 28, wherein the chamber further comprises a third portion having a barrel body having two non-overlapping cylindrical bores having internal walls that are substantially parallel and the two feed screws are rotatably supported in the two non-overlapping cylindrical bores of the barrel body,
25 wherein the helical threads of the two feed screws are in sliding contact with the internal walls of the third portion of the chamber and where the helical threads of the two feed screws are non-intermeshing.

33. A method of dispensing a liquid from a dispensing apparatus comprising the
30 steps of:

introducing a first component liquid to at least one feed screw disposed within a chamber;

introducing a second component liquid to the at least one feed screw independent of the introduction of the first component liquid;

5 rotating the at least one feed screw the a pre-selected amount, to mix the first and second component liquids forming a liquid product and dispense a measured amount of the liquid product.

34. A method of dispensing a liquid from a dispensing apparatus comprising the
10 steps of:

introducing a first component liquid to a first feed screw disposed within a chamber;

introducing a second component liquid to a second feed screw disposed within the chamber;

15 counter rotating the first and second feed screws a pre-selected amount, to mix the first and second component liquids forming a liquid product and dispense a measured amount of the liquid product.

35. A method of dispensing a liquid from a dispensing apparatus comprising the
20 steps of:

introducing a first component liquid to a first feed screw disposed within a chamber;

introducing a second component liquid to a second feed screw disposed within the chamber;

25 co-rotating the first and second feed screws a pre-selected amount, to mix the first and second component liquids forming a liquid product and dispense a measured amount of the liquid product.